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Tae-Hee Cho

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KED & ASSOCIATES, LLP
P.O. Box 221200
Chantilly, VA 20153-1200

EXAMINER

VAN OUDENAREN, SARAH A

ART UNIT

PAPER NUMBER

1793

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DELIVERY MODE

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|--|-----------------------------------|--|
| Office Action Summary | Application No. 10/596,917 | Applicant(s) CHO ET AL. | |
| | Examiner SARAH VAN OUDENAREN | Art Unit 1793 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 June 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 18-27 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 June 2009 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Claims 18-27 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 6/8/2009.

Applicant's election with traverse of claims 1-17 in the reply filed on 6/8/2009 is acknowledged. The traversal is on the ground(s) that the restriction is improper as there would be no burden when searching. This is not found persuasive because the inventions do not have unity of invention as being drawn to a fuel cell system (group I) and a method of control (group II).

The requirement is still deemed proper and is therefore made FINAL.

Claim Objections

Claim 9 is objected to because of the following informalities: line 2 recites "the heating unit as a proper level" examiner believes "as" should be "at". Appropriate correction is required.

Drawings

Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid

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abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance. It is noted that in applicant's own disclosure, figure 1 is referred to as depicting "conventional art".

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: specifically figure 1, number 126. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 13 recites the limitation "the hydrogen exhausting line" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claims 1-17 are drawn to a fuel cell stack; however the limitations only recite a singular anode, cathode, and electrolyte. One of ordinary skill in the art would recognize that the recitation of a fuel cell stack would result in a repeating plurality of an anode, cathode, and electrolyte to effectively form a stack.

Further, claim 13 is unclear as it discusses a hydrogen flow sensor and temperature sensor for sensing flow and temperature, respectively. It is unclear to examiner how the applicant relates the temperature sensor discussed in line 5 to the electric signal which opens/closes the valve based upon the exhaust line flow sensor.

Claim Rejections - 35 USC § 102/103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

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The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 1 is rejected under 35 U.S.C. 102(a) as being anticipated by or in the alternative under 35 U.S.C. 103(a) as obvious over Takahiro et al (JP 2003-077506).

Takahiro teaches a main fuel cell stack and an auxiliary fuel cell stack where air is supplied to the air electrode and hydrogen fuel is supplied to the hydrogen electrode and an electrolyte in between, wherein the exhaust gas from the hydrogen electrode of the main stack is used to supply the hydrogen electrode of the auxiliary fuel cell stack (see abstract and figure).

In the alternative, as Takahiro does not explicitly teach a fuel supplying unit or an air supplying unit, it would have been obvious to one of ordinary skill in the art at the time of the invention to include units for the supply of air and hydrogen, insofar as air and hydrogen are supplied to their respective electrodes and a unit is most often needed to supply such things in order to capture these elements either from the atmosphere as with air or to produce as with hydrogen.

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Claims 2-8 and 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahiro et al (JP 2003-077506) as applied to claim 1 above, and further in view of Petillo et al (US 7,282,073).

Takahiro teaches a main fuel cell stack and an auxiliary fuel cell stack as discussed above.

Takahiro does not explicitly teach a separator or a recycle line.

Petillo teaches a fuel generation system wherein the generated hydrogen and discharged solution flow into a separator. The hydrogen and steam exit the separator via a vent or by being collected. The discharged solution can be drained from a drain valve or recycled back to a liquid fuel solution or a solid fuel component (col 5, lines 25-35). The generated hydrogen can also be coupled to one or more storage vessels (col 3, lines 1-10 and fig 1). It would have been obvious to one of ordinary skill in the art at the time of the invention include the separator and recycle line of Petillo with the system of Takahiro in order to efficiently use the exhausted products. As a separator is needed in order to obtain a usable exhaust as fuel as is used in Takahiro, a separator would be obvious and a recycle line for utilizing the recycled gas which is utilized in both Takahiro and Petillo would also have been obvious to one of ordinary skill in the art at the time of the invention.

Regarding claim 3, Takahiro does not explicitly teach NaBH_4 as fuel. Petillo teaches solutions of NaBH_4 , a stabilizer, and water are used as fuel (col 1, lines 30-40) and the fuel is advantageous insofar as it can be generated as needed (col 2, lines 10-40). Further, Petillo teaches the hydrogen gas produced from a sodium borohydride

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reaction is typically very high in purity and is therefore advantageous to utilize in PEM and alkaline fuel cells (col 3, lines 25-50). It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the NaBH_4 of Petillo with the system of Takahiro as it is a known alkaline solution to use in a fuel cell as well as it is advantageous regarding transport and its ability to produce high purity hydrogen.

Regarding claim 4, Petillo teaches that PEM fuel cells require high purity hydrogen which is produced by the reaction of NaBH_4 (col 3, lines 25-50). It would have been obvious to one of ordinary skill in the art at the time of the invention for the auxiliary cell of Takahiro to be a PEM fuel cell insofar as Petillo teaches the exhaust of a generation using NaBH_4 is high purity hydrogen which is required for PEM fuel cells and further as it is a known and widely used fuel cell.

Regarding claim 5, Takahiro teaches the auxiliary stack to have a hydrogen and air electrode (anode and cathode respectively) and an electrolyte (see abstract and figure).

Regarding claim 6, Petillo discusses running the fuel and air over a catalyst bed to create hydrogen (col 1, lines 30-50 and col 9, lines 5-20 and fig 1 and 5). It would be obvious to one of ordinary skill in the art at the time of the invention to recognize this process would require heat and that it would also have been obvious to one of ordinary skill in the art to utilize a heated element already present within the system such as hydrogen which is generated at the anode as it will be of a sufficient temperature to heat the supply gases.

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Regarding claim 7, Takahiro does not explicitly teach a separator or a recycle line. Petillo teaches a fuel generation system wherein the generated hydrogen and discharged solution flow into a separator. The hydrogen and steam exit the separator via a vent or by being collected. The discharged solution can be drained from a drain valve or recycled back to a liquid fuel solution or a solid fuel component (col 5, lines 25-35). The generated hydrogen can also be coupled to one or more storage vessels (col 3, lines 1-10 and fig 1). It would have been obvious to one of ordinary skill in the art at the time of the invention include the separator and recycle line of Petillo with the system of Takahiro in order to efficiently use the exhausted products. As a separator is needed in order to obtain a usable exhaust as fuel as is used in Takahiro, a separator would be obvious and a recycle line for utilizing the recycled gas which is utilized in both Takahiro and Petillo would also have been obvious to one of ordinary skill in the art at the time of the invention.

Regarding claim 8, Takahiro teaches a valve which allows a part of exhausted gas from the main stack to be utilized as fuel for the auxiliary stack otherwise it is exhausted away from the system (see abstract) Petillo teaches a recycle line and separator as discussed above. It would have been obvious to one of ordinary skill in the art at the time of the invention for the valve to either allow the gas from the separator to the auxiliary stack or to recycle, which as discussed above is via a catalytic reactor, as it would be the only way to efficiently use the exhaust from the main stack to fuel the auxiliary as in Takahiro and the only way to efficiently recycle the gas as in Petillo when combined with Takahiro.

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Regarding claim 15, Takahiro does not explicitly teach NaBH_4 as fuel. Petillo teaches solutions of NaBH_4 , a stabilizer, and water are used as fuel (col 1, lines 30-40) and the fuel is advantageous insofar as it can be generated as needed (col 2, lines 10-40). Further, Petillo teaches the hydrogen gas produced from a sodium borohydride reaction is typically very high in purity and is therefore advantageous to utilize in PEM and alkaline fuel cells (col 3, lines 25-50). It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the NaBH_4 of Petillo with the system of Takahiro as it is a known alkaline solution to use in a fuel cell as well as it is advantageous regarding transport and its ability to produce high purity hydrogen.

Regarding claim 16, Petillo teaches that PEM fuel cells require high purity hydrogen which is produced by the reaction of NaBH_4 (col 3, lines 25-50). It would have been obvious to one of ordinary skill in the art at the time of the invention for the auxiliary cell of Takahiro to be a PEM fuel cell insofar as Petillo teaches the exhaust of a generation using NaBH_4 is high purity hydrogen which is required for PEM fuel cells and further as it is a known and widely used fuel cell.

Regarding claim 17, Takahiro teaches the auxiliary stack to have a hydrogen and air electrode (anode and cathode respectively) and an electrolyte (see abstract and figure).

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Claims 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahiro et al (JP 2003-077506) as modified by Petillo et al (US 7,282,073) as applied to claims 2-7 above, and further in view of Parr et al (US 2003/0022037).

Takahiro as modified by Petillo teaches the system as discussed above. Takahiro teaches utilizing the valve for controlling hydrogen to the auxiliary stack (see abstract). Neither teaches a controller. Parr teaches a fuel cell system where an open and close valve supplies fuel based on a micro controller (pg 4, 0059). It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the controller of Parr with the system of Takahiro and Petillo in order to effectively control the valve. It is noted that the intended use of the controller for maintaining a temperature is not considered to limit the claim insofar as the system seems to be based upon structural elements. Further, as the valve discussed above is controlled in order to affect hydrogen flow, it would also maintain temperature as the claim language implies the temperature control is a result of the control over hydrogen flow.

Regarding claim 10, Parr teaches a temperature sensor (pg 1, 0008) as well as the microcontroller being subject to electrical signals (pg 1, 0011 and pg 4, 0061 and pg 5, 0065 and pg 6, 0072). It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize such a control method as it is efficient and does not require constant human interaction by the operator.

Regarding claim 11, Parr teaches the temperature sensor sensing the stack heat which is a heat generating part (pg 1, 0008) as well as a hydrogen heat current sensor (pg 4, 0058). It would have been obvious to one of ordinary skill in the art at the time of

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the invention to utilize any of the sensors present in the system to adjust the valve dependent on what the particular process deems a valuable and reliable measurement of which would most efficiently dictate process conditions.

Regarding claim 12, Parr teaches a hydrogen concentration (pg 4, 0058) and the microcontroller providing signals to actuators which control several valves as a result of such a measurement (pg 5, 0065). It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize any of the sensors present in the system to adjust the valve dependent on what the particular process deems a valuable and reliable measurement of which would most efficiently dictate process conditions.

Regarding claim 13, Parr teaches multiple flow sensors and electrical signals from such sensors controlling actuators and valves (pg 5, 0065 and pg 1,0008 and pg 6, 0072). It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize any of the sensors present in the system to adjust the valve dependent on what the particular process deems a valuable and reliable measurement of which would most efficiently dictate process conditions.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takahiro et al (JP 2003-077506) as modified by Petillo et al (US 7,282,073) as applied to claim 7 above, and further in view of Chen et al (US 2002/0098397).

Takahiro as modified by Petillo teach the system as discussed above.

Neither teaches the heating unit with a housing, fan and combustor.

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Chen teaches a catalytic humidified and heater for a fuel stream of a fuel cell. Chen teaches a housing which holds the fuel lines (pg 3, 0040) as well as a catalytic reactor (pg 3, 0042 and pg 2, 0013) and a fan to enhance air flow (pg 2, 0012). The catalytic reactor within which a catalyst is mounted to which oxygen and hydrogen combust is considered a combustor.

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the system of Chen with the system of Takahiro as modified by Petillo in order to more efficiently accompany the catalytic reactor of Petillo, discussed above, as well as more efficiently utilize the fuel of the separator as discussed above. A housing would have been obvious insofar as it would protect the lines and maintain the temperature which is desired better than if open to ambient air.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SARAH VAN OUDENAREN whose telephone number is (571)270-5838. The examiner can normally be reached on Monday-Thursday, 9:00-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Melvin Curtis Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/SARAH VAN OUDENAREN/
Examiner, Art Unit 1793
August 26, 2009

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1793